Accent Monitoring Group, LLC

GENEREX Systems
The BACS Battery Management System
Description and Specification

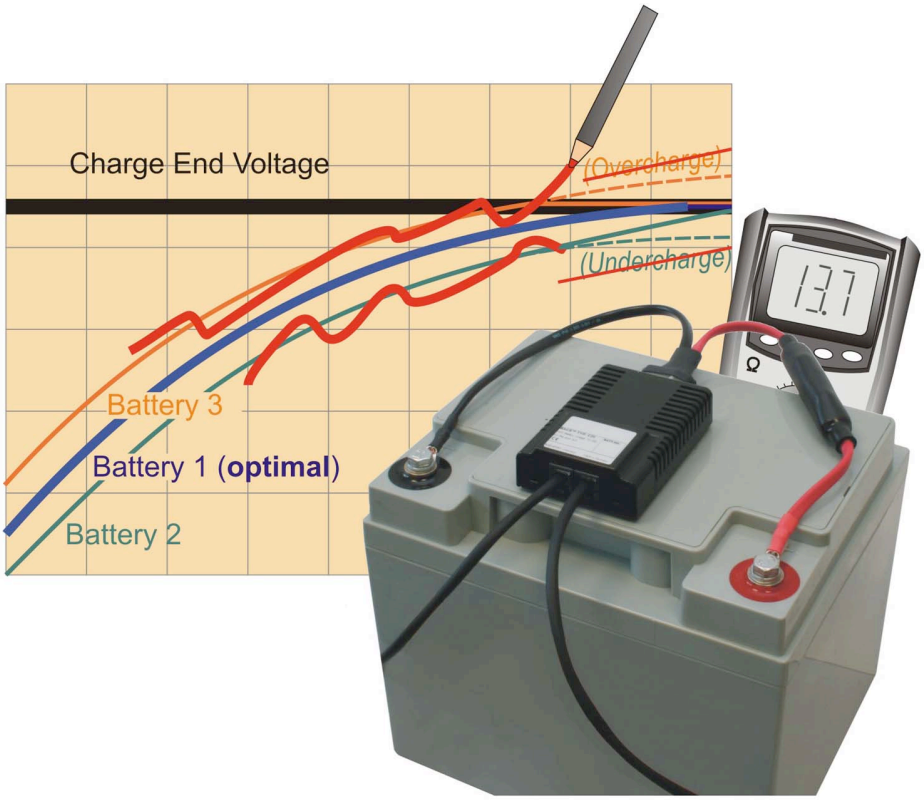


Table of Content

		Page
1.	Introduction	1
2.	Who will benefit from this Document	1
3.	Battery Environments and Issues	1
4.	General Overview	2
5.	The BACS Battery Management system	2
6.	BACS Hardware Components	3
7.	System and Technical Data	5
8.	Key Features of the BACS SYSTEM	5
9.	Monitored parameters within the system	7
10.	Battery management and Alert System	8
11.	Software and Network Communication	9
12.	Regulatory approvals	9
13.	Test Documentation	10
14.	Manufacturing Capability and Quality Standards	10
15.	Delivery Requirements	10
16.	Monitored Data for Display and Software Tools	10
17.	Service TOOLS	12
18.	Documentation	13
19.	Training	14
20.	Spare Parts	14

1. INTRODUCTION

This document describes the detail and specification of "The GENEREX BACS Battery Management System" for Engineering Consultants and our Channel Partners who purchase and install our products. This document also includes information on our documentation and training support for our Channel Partners.

2. WHO WILL BENEFIT FROM THIS DOCUMENT

This document provides valuable information for Data Centre Managers, Facility Managers, Telecommunication site Managers, Engineers, Consultants, and Service Providers who are involved in Battery back-up Power applications. Who need a highly comprehensive Battery Management Solution to support their Power Systems?

3. BATTERY ENVIRONMENTS AND ISSUES

BACS® – is the most economic professional individual battery monitoring and management solution for stationary batteries used for avoiding UPS failures!

In the past, considerable costs resulted from the regular replacement of lead acid batteries in UPS devices. This was a precautionary measure since the user could not precisely determine the current status of the individual batteries and the performance data of the individual battery did not exist. Those who did not replace the battery for cost reasons found themselves walking on a tight rope between security and the complete failure of the UPS system. For static UPS devices, the danger of undiscovered defect batteries is always present and once the need arises this will cause a total UPS failure.

Standby battery systems are a large and important part of the back-up power for both UPS and telecommunication applications. The constant high performance of each battery within a battery system is therefore vital to guarantee that the battery is able to support the load when required. The continuous monitoring of each battery is therefore paramount to make sure that it performs when required.

The problems with VRLA Batteries are already well known: - sulphation of plates, grid corrosion and excessive gassing to name a few. The BACS system will be able to monitor and identify the cause of the problem before the failure has an impact on the overall battery performance and also able to overcome many of the identified battery problems.

Battery Monitoring systems that are on the market today are just monitoring systems that just show a mix of measurement information (Voltage differences, rising impedance etc.) but since they are only a monitoring system they provide no counter reactions. The GENEREX BACS system offers you a Battery Management System with its Patented Conditioning process to increase durability and reliability of the whole system.

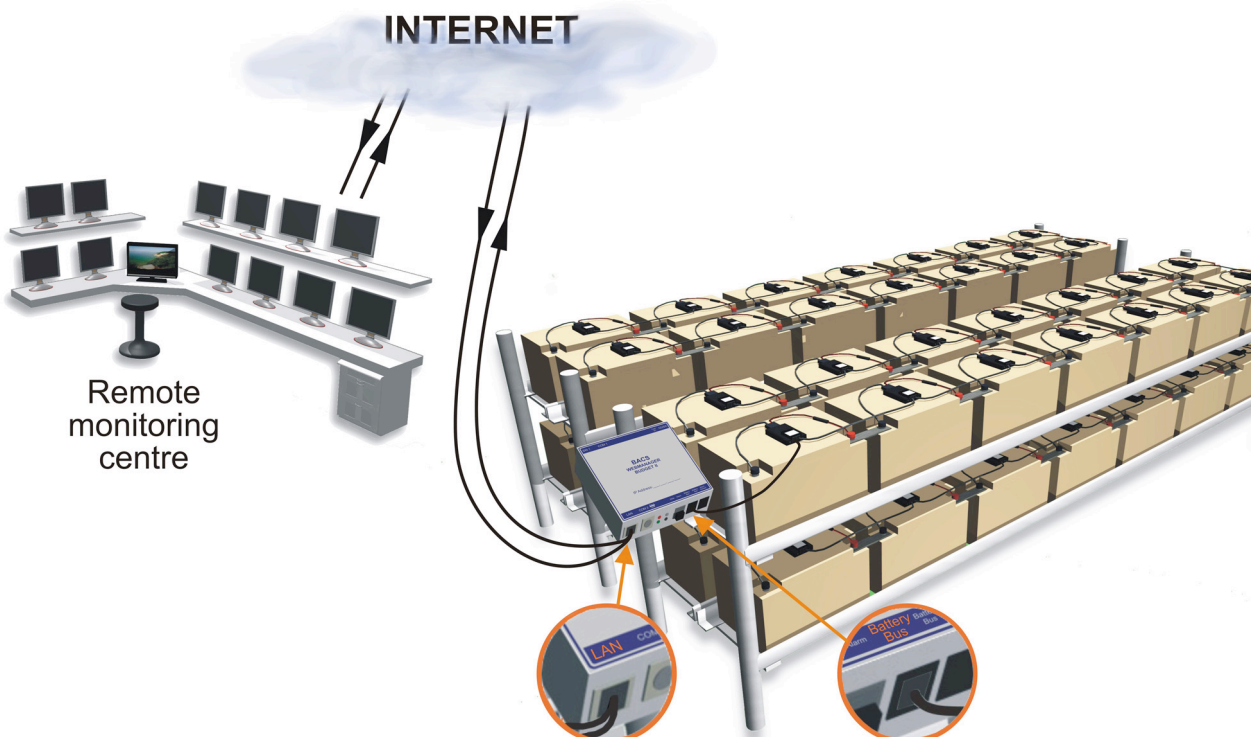
4. GENERAL OVERVIEW

Our Channel Partners will supply a complete BACS Battery Management System for monitoring and managing lead acid batteries, VRLA, Wet and NiCad. The system consists of all the hardware and software components plus cabling to install a safe system that will collect and display the battery/battery data

5. THE BACS BATTERY MANAGEMENT SYSTEM

The patented BACS® „**B**attery **A**nalysis and **C**are **S**ystem“ is the 3rd generation Battery Monitoring and Management system that is integrated into the network. It periodically checks the internal resistance, temperature and voltage of each individual battery. In addition, it can regulate the loading charge of each battery and monitor the ambient conditions (temperature, air humidity, external alarms, hydrogen gas content and so on) and the different loads (UPS, inverters and other devices). The constant monitoring and controlling of the individual charging voltages for each battery will ensure the availability of the battery at all times and it will notify the user immediately of the quality of the battery being used in comparison to each other. BACS® is suitable for all lead based batteries (AGM, GEL, closed, and sealed batteries).

The GENEREX Patented “Conditioning” function harmonizes the individual battery voltages in the strings and therefore avoids overcharges or undercharges which results in a longer lifespan of the complete battery system.



6. BACS HARDWARE COMPONENTS

The BACS WEBMANAGER is the central control unit for the system, where all information will be interpreted and stored. The central unit provides control and information not only for the Battery Management system but also for the UPS status and any Environmental products connected within the system. For the battery management system the BACS Web-manager calculates constantly the reference value of the charging voltage, ensuring every battery has the correct overall voltage. If any battery deviates from the average charging voltage the BACS WEBMANAGER sends a correction command to the specific BACS module to manage this battery. This individual charging/discharging of batteries is our patented “Conditioning” process.

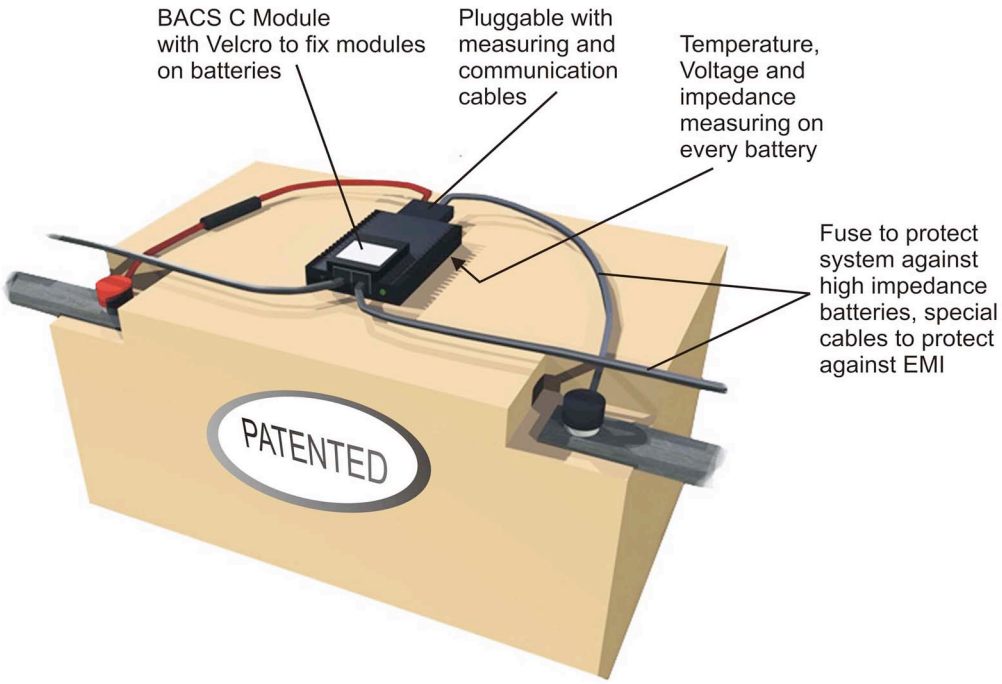
The values for the internal impedance, the voltage and the temperature will also be collected and monitored through the BACS WEBMANAGER. The BACS WEBMANAGER has an internal Flash-ROM of at least 32MB (BUDGET version), which is able to store all battery data up to 2 years (depending on the number of batteries).

The system can be configured to raise alarms when key parameters both early warning or risk levels are reached. These alarms will be logged with all the data and routed via the network email, SMS, SNMP or RCCMD or (optional) modem. The alarm system provides an audible sound via a local buzzer and an Alarm LED plus dry contacts for external interfaces. Alarms are also readable in the MODBUS format at one of the serial interfaces and/or MODBUS over IP.

The new BACS Web-manager version II can manage and control up to 300 battery modules. The battery modules can be split into 10 parallel strings. The current state of the batteries and the UPS (if the UPS is serial connected) are displayed via the web-browser and optically and acoustically through an LED and a buzzer and on the dry contact alarm output.

The BACS WEBMANAGER provides a web interface and several other interfaces to remotely access the stored data and to send out alarm message (network message, modem, email, SMS, SNMP, MODBUS and the options, PROFIBUS and LONBUS.

The control of the charging and discharging activity of each battery during the Conditioning process and the measuring of the actual state of the battery (Voltage, Temperature and Impedance) is transmitted through the BACS C-modules, which are mounted on every battery. The accordant C-module for your battery system is dependent on the battery type (Voltage). The modules are available for 2V, 4V, 6V, 12V & 16V batteries. For technical details about the BACS system please refer to the latest data sheet available provided by Accent Monitoring Group, LLC .


BACS C Module with Velcro to fix modules on batteries
Pluggable with measuring and communication cables
Temperature, Voltage and impedance measuring on every battery
Fuse to protect system against high impedance batteries, special cables to protect against EMI
PATENTED

Patented **"Patent "Conditioning" process that balances the string voltage of each battery.**

7. SYSTEM AND TECHNICAL DATA

The BACS system has unlimited capacity to support any battery configuration:

- A Web-manager can support up to 300batterieswith 1-10 parallel strings that could include current sensors in each string and a ambient temperature and humidity sensor. This is apart from a connection to a UPS unit to provide status information and a Sensor manager for multi sensor input/output connection for Environmental Monitoring
- There is an a unlimited number of Web-managers that could be connected onto a LAN/WAM network each with its own unique IP address

The BACS components provide the following measurement ranges:

- The voltage measurement range for modules are from NiCad, 2vDC to 16v DC with a measurement tolerance of less than 0.5%
- The modules internal resistance measurement tolerance for each battery is less than 10%
- The temperature sensor within the module operations from 1-85C and the measurement tolerance is less than 5%
- The MTBF for all the modules is 70,000 hours (8 years)
- The Web-manager has a 32-Bit RISC-processor with 32 MB storage and 64 MB RAM
- All BACS components are capable of operating temperature conditions of 0 – 60 C max and a humidity of 90%

8. KEY FEATURES OF THE BACS SYSTEM

Conditioning

- Brings over and under-charged batteries to a balanced voltage level.
- Provides the ideal utilisation of the battery capacity (up to 18% more capacity) and increases the lifespan

Individual cell voltage measurement

- To determine the imbalance between cells in a battery string to provide additional information that a potential cell is failing

String and battery voltage measurement

- Provides an early indication that the cell is failing
- Battery String Current shows differences between the strings during the charge and discharge phase

Individual impedance measurement

- A major indicator for trending the performance of a cell for failure

Individual cell temperature measurement

- Mapping out the heat of the battery
- Essential in the detection of potential thermal runaway
- Important when cells are installed in a battery cabinet
- Auto switch off of Power breaker

Progressive "alarm" management

- Fully programmable for key parameters that indicate an issue needs to be addressed
- Settings on: Voltage, Temperature and Impedance.

Easy to Install

- Installation is fast and inexpensive with snap-in pre-terminated cables

History Trending and Performance Analysis

- Provides user with historical information to review performance of the cells
- Trending of impedance data over time can be vital in detecting a failing cell

Discharge and recharge performance data

- Float and discharge current measurements per string
- Different current values between strings can indicate failing cells
- Storage of cell information during a discharge for view later

Innovative technology

- GENEREX is the first to introduce the Conditioning process for batteries, based on an auto-adaptive control logic which was patented in 2004.

Safety

- GENEREX BACS products are the only battery management system within the market which is fuse protected. Through the power cables fuses allow the system to automatically disconnect the measuring sensor from the battery in case of overheating or other massive failures of a battery and is therefore the only BMS sensor which is can be installed in hazardous locations. Additionally all BACS sensors are coated against corrosive situations and are designed to work in industrial applications.

9. MONITORED PARAMETERS WITHIN THE SYSTEM

Individual battery voltage measurement; during float

- To determine the imbalance between an battery in a battery string to provide additional information that a potential battery is failing

Individual battery voltage measurement; during a discharge

- To determine a potential battery that is failing

String and battery voltage measurement

- Provides an early indication that the battery is failing
- Battery String Current shows differences between the strings during charge and discharge phase

Individual impedance measurement

- A major indicator for trending the performance of a battery for failure

Individual battery temperature measurement

- Mapping out the heat of the battery
- Essential in the detection of potential thermal runaway
- Important when cells are installed in a battery cabinet

Additional key areas that are monitored

- Conditioning voltage of all individual batteries
- Discharge and Re-charge current
- Ambient and Humidity measurement
- Additional sensors for measuring (environmental situations ie. what is the fuel level in the generator and can I switch this on remotely - “Yes”)

All the above measurement points have pre-programmed levels that if any of these monitored points exceed pre-determined limits, the BACS system creates an alarm alert condition. This information will be stored in Log register and then communicated via a pre-set of communication methods.

10. BATTERY MANAGEMENT AND ALERT SYSTEM

a) Conditioning of voltages within a Battery string

The BACS system uses an „auto-adaptive“ control process to provide individual charging and discharging voltage of every battery within the battery system. The BACS Web-manager (control unit) collects the voltages of every single battery via the communication bus and sets a target voltage level for every battery. The BACS modules will now cooperate to equalise the voltage of all batteries to reach this final target level at the same time, not leaving any battery behind or allow batteries to drift beyond tolerate voltage thresholds. That means if any battery with higher impedance tries to hoist the voltage at the on-going charging current, the BACS module activates a bypass and through this, redirects the charging current from this battery to others which may require extra charge. Thus the voltage of this battery remains constant around this set point and will follow in any change as soon as the central unit alters this set point. Through this optimized charging of each battery

The free BACS VIEWER software shows the CONDITIONING of a battery (shown as bold violet line) during a discharge/ recharge process – BACS CONDITIONING avoids that this battery gets overcharged since other batteries still require further charging.

via the BACS „Conditioning“ process, full charge level of every battery in the battery string is archived, which results in a up to 18% high battery capacity compared with non-Equalized system. Furthermore it avoids that a single battery will be overcharged (avoids gassing or dry out) or undercharged. Due to the above mentioned, “care” charging of the battery, a dramatic higher service life and reliability is possible. The charging difference, until a replacement is possible, will be fully balanced through the BACS „Conditioning“ process.

b) Alarm Alert Systems

The system can be configured to raise alarms when key parameters both early warning or risk levels are reached. These alarms will be logged with all the data and routed via the network, email, SMS, SNMP or RCCMD or (optional) modem, Profibus and Lonbus. The alarm system provides an audible sound via a local buzzer and an Alarm LED plus dry contacts for external interfaces. Alarms are also readable in the MODBUS format at one of the serial interfaces and/or over MODBUS over IP.

11. SOFTWARE AND NETWORK COMMUNICATION

Through an IP address and the internet and a LAN/WAN network connection to a remote computer you can communicate with any of the Web-managers to view the status of the UPS system, BACS Battery Management and any Environmental products. When communicating direct with the Web-manager you are able to display live data for all the key system measurement points plus all data, which is stored locally on the Web-manager.

The system can be configured to raise alarms when key parameters both early warning or risk levels are reached. When any of the threshold values are exceeded, corresponding alarms will be communicated using e-mail, SMS, SNMP, RCCMD, MODBUS, and (optionally) a Modem, PROFIBUS or LONBUS.

GENEREX also provides a Battery Management Software Tool, the BACS Viewer as a database for storing history files that are downloaded from the Web-manager. The information provides graphical display for batteries and batteries data analysis and trending of performance over time. This software runs on Windows software.

12. REGULATORY APPROVALS

The BACS GENEREX System has UL, CSA and CE approvals

a. For electrical noise emissions and susceptibility.

International Test results

- EN55022:2006 + A1: 2007

North America Test results

- FCC 47 CFR Part 15, Subpart B for Digital Devices
- ICES – 003 Issue 4 February 2004

b. For electrical safety.

- CAN/CSA C22.2 No 60950
- UL60950-1
- IEC60950-1 2rd ED (205-12)

13. TEST DOCUMENTATION

Accent Monitoring Group is able to supply you with copies of the system test report and quality approval documentation.

14. MANUFACTURING CAPABILITY AND QUALITY STANDARDS

GENEREX has two manufacturing supply locations for all hardware and software products to support our world-wide Channel Partner Network.

Our manufacturer in Germany is:

- INTEG

Integrationsbetrieb für Behinderte GmbH
Groppendiek 2
33014 Bad Driburg
Germany

Our manufacturer in USA is:

- Advanced Assembly Inc.

5901 Research Park Blvd,
Madison WI 53719
USA

Both manufacturers are certified and currently registered with a National Quality Approval Agency for ISO9002

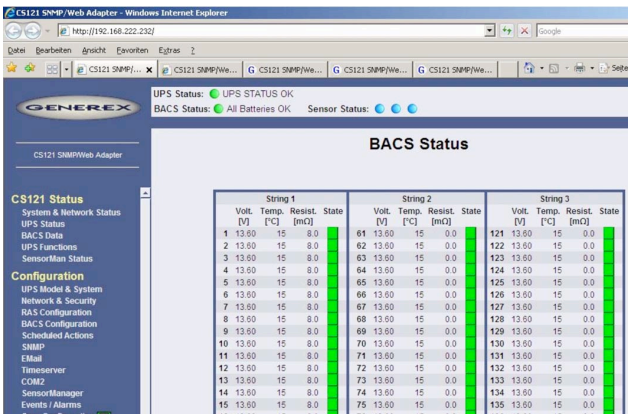
15. DELIVERY REQUIREMENTS

GENEREX is able to ship to its Channel Partners all hardware and software products from its two distribution centres based in Hamburg Germany and Madison USA.

All shipments will include the User and installation documents, with full manuals available from the GENEREX Web-site.

16. MONITORED DATA FOR DISPLAY AND SOFTWARE TOOLS

GENEREX provides two methods for viewing the BACS Battery management data, live via the Web-manager or data that is downloaded to the BACS Viewer for performance analysis and battery trending of data.



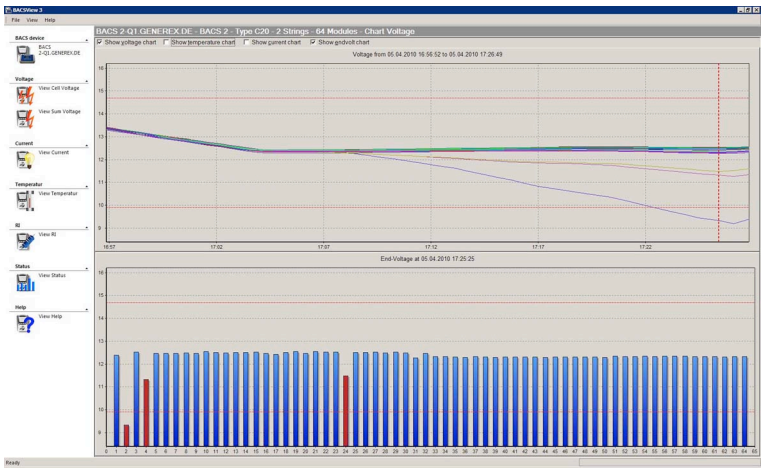
A) BACS WEBMANAGER data display

BACS® web server displays here the battery status of 140 batteries. Any change in impedance, temperature and voltage is displayed and stored. Status LEDs show a change of color if any battery drifts beyond thresholds.

When you are communicating directly with the Web-manager via an IP address you will be able to see the BACS Battery Management and any Environmental products, plus any UPS status conditions if connected. This information will show you live data for all key measurement points within the system. This information is stored locally and for the BACS Battery data is available for download to our BACS Viewer for management analysis.

B) BACS VIEWER

The BACS Viewer is the software Battery Management tool that provides Graphical information of History files and comprehensive Data on each of the batteries within the battery system and is free from the GENEREX Web-site.
This will allow the User to view historical data for trending and analysis of Performance to manage the Battery system and any scheduling of the maintenance programs.



BACS VIEWER shows the individual battery voltage of all batteries at the end of a discharge. The red dotted line shows the voltages when power has returned. In the lower bar graph is shown which batteries have collapsed earlier than others and have been discharged to a very low level. These batteries are a risk to the complete system.

The Benefits

- Reduces the time required to review Battery Data
- Allows for easy Graphical Analysis and Data Interpretation
- Becomes a planning tool for scheduling Maintenance work
- Reduction in resource required to gather the System Data

Features

- Communicates with Multiple Web-managers via LAN or Internet, offline (SD Card, email transfer of logfiles, import of logfiles)
- Captures Archives, Reports and Graphically Displays Data by Location
- Uses a database to store information for easy retrieval
- Displays Voltage, Temperature, Current and Impedance trends
- Provides trending data per cell on Conditioning, Impedance and Temperature
- Displays Logging data of Events and Parameter settings
- All Measurements displayed by Day/Month/Quarter/Year
- Allows for Trending Analysis against High, Low and Avg cells

17. SERVICE TOOLS

A System Installation

BACS is a plug-and-play system, easy to install, using pre-assembled power/measuring and bus communication cables. The system provides you with automatic addressing and default thresholds for most battery types. It provides optical isolated bus system and several fuses for protection against high impedance batteries, wrong setup or other damages at the battery or the installation itself.

B Control Cabinets

GENEREX provide OPTIONAL fully enclosed Control Cabinets for housing the Web-manager and power units if required. The units provide optical and audible display on the outside door, protection class IP 56. Only the power supply and Ethernet cables have to be provided by the Channel partner. Easy connection of input and output through a strip terminal.

C The GENEREX Service Tools

C.1 Remote Monitoring and System Control with our Service Tools

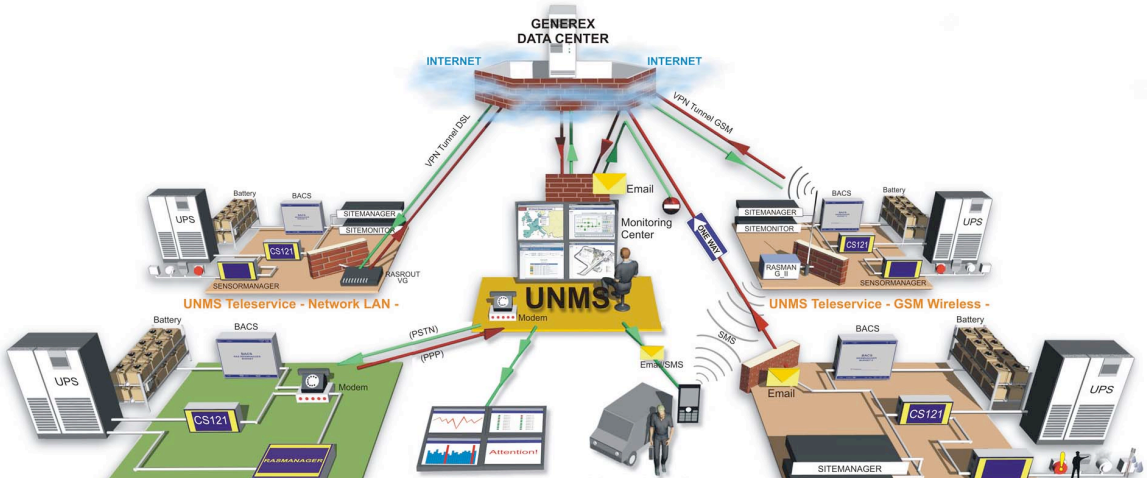
GENEREX provides a wealth of Software Management Service Tools to help its Channel Partners in providing performance data and control information to help them run their operational service group to support their Customer base. These tools allow our Channel Partners to monitor and manage many system devices remotely via their own commard centre in live situations providing their engineers with critical data to make a discussion on the course of actions to be taken. These tools are a vital part of any service operational strategy that not only increases productivity but also Customer level of satisfaction.

C.2 UNMS Management Software

UNMS II is a network monitoring and management software system that can be individually customized to manage your service operational requirements. Not only can UNMS II manage UPS systems and other power supply devices but also things like environmental sensors and alarm contacts as well as a BACS Battery Management System. UNMS II runs as a system service on Windows 2003, 2008, XP and Windows 7 and collects the status information of all system objects and determines the status of their condition and alarms. The status of the alarm devices are displayed on different graphic levels and can be configured to execute any user defined actions in case of an alarm. UNMS II is completely web based and can be operated from any WAN/LAN workstation. User groups can be defined and configured for controlling the authorization of different users, restricting certain parties to monitoring only and giving authorized users administration privileges. For example, the central administrator can monitor and if necessary take action to manage all of the processes in the network.

One unique feature of UNMS II is its ability to allow system administrators to freely design its user interface making it simple and intuitive enough that even users with practically no network experience can use it easily. The individual usage of backgrounds and different graphical representations on various levels (i.e. overview country, city, building, room, UPS) quickly guide users to the source of problems in even the most complex systems and on the other side, makes the installation of integrating single devices into such complex systems much easier. This is an ideal product that any service operation should have installed to give you up to date current status at anytime and help with the diagnostic of a problem situation that will allow the engineer

to take the appropiate actions.No other network management system can do this! UNMS II is available for networks of different sizes (10, 50, 150, 250, 500 and for those with over 1000 objects) and the management of BACS Battery Management systems. This is a very powerful service tool to help the User and the Service Company to manage the Battery systems and to plan predictive maintenance.



Connection between the monitoring devices and the UNMS Management Software can be established in 4 different ways:

A. TCP/IP Network connections via LAN,
B. VPN tunnel via secured Internet connection,
C. Wireless GSM/EDGE network connection via VPN tunnel by the GENEREX DATASERVER portal,
D. In the push mail mode “Email Trap” with the usage of SMTP.

The UNMS II can run on all 4 modes at the same time and therefore all installed devices of an end-user can be monitored from anywhere.

18. DOCUMENTATION

Full document for the BACS Battery Management System is available for downloading from the GENEREX web-site that include:

- GENEREX Corporate Brochure
- User and Technical Manual
- BACS Data sheets
- BACS Viewer user Manual

19. TRAINING

GENEREX provides a very comprehensive training programme to support its Channel Partners. Training is part of all our Channel Partners Programme to be certified to sell and install our BACS systems. This training course will include:

- BACS system Overview
- Installation requirements
- User set-up including alarms
- Web-manager display data analysis
- BACS Viewer analysis and trending review
- Interpretation of Battery data

20. SPARE PARTS

Spares parts are available for existing and past systems and documents of the list are available.